The state of the art in management of olfactory disorders

Essay protocol

Submitted for partial fulfillment of
Master degree in Otorhinolaryngology

Presented by

Ahmed Abdel Khalek Attia Radwan
(M.B.B.Ch., Cairo University)

Supervised by

Prof. Dr.Mohamed Abdel Rahman Elshazly
Professor of Otorhinolaryngology
Faculty of Medicine
Cairo University

Dr. Ahmed El Farouk Abdel Fattah
Assistant professor of Otorhinolaryngology
Faculty of Medicine
Cairo University

2012

Abstract

The impact of disorders of smell on quality of life is significant. Moreover, this chemosensory lose can leave patients vulnerable to the serious hazards of spoiled foods, smoke, and natural gas. As clinicians, the impact of these losses is often overshadowed by other medical problems. Often, the inability to successfully treat many of these disorders is frustrating for both the patient and clinician

Key word:

olfactory disorders- Otorhinolaryngology- Classification of Olfactory- Etiology of Olfactory

Acknowledgment

Thanks to ‘God’ for all His gifts and His blesses.

It is a great pleasure for me to acknowledge the assistance and contributions of many individuals in making this review a success.

First and foremost, I would like to thank my supervisor, Professor Elshazly for his assistance, ideas, and feedbacks during the process in doing this review. Without his guidance and support, this review can not be completed as is.

I am heartily thankful to my supervisor, Dr.Elfarouk, whose encouragement, guidance and support from the initial to the final level enabled me to develop an understanding of the subject. He always kept me on track when I tended to stray.

I am indebted to my dear professors, staff members and colleagues for their help and support.

I offer my regards and blessings to all of those who supported me in any respect during the completion of this review.

Lastly, I wish to express my sincere gratitude to my big and small family for their encouragement and moral support.

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AD: Alzheimer's Disease.

AON: Anterior Olfactory Nucleus.

BAST: Barcelona Smell Test.

CCCRC: Connecticut Chemosensory Clinical Research Center.

CC-SIT: Cross-Cultural Smell Identification Test.

CN: Cranial Nerve.

CNS: Central Nervous System.

Co: Company.

COT: Combined Olfactory Test.

CT: Computed Tomography.

D: Discrimination.

DC: District of Columbia.

DDTC: Diethyldithiocarbamate.

ENT: Ear, Nose and Throat.

EPs: Evoked Potentials.

ETOC: European Test of Olfactory Capabilities.

FD: Fibrous Dysplasia.

Hz: Hertz.

ID: Identication.

Mm: Millimeter.

MRI: Magnetic Resonance Imaging.

mRNA: Messenger Ribonucleic Acid

ND: Not Determined.

OBLV: Olfactory Bulb Line Variant.

OCM: Odor Confusion Matrix.

OE: Olfactory Epithelium.

OEPs: Olfactory Evoked Potentials.

OM: Odor Memory.

OMT: Odor Memory Test.

ORNs: Olfactory Receptor Neurons.

OSNs: Olfactory Sensory Neurons.

PD: Parkinson's Disease.

PDR: Physician's Desk Reference.

PEA: Phenyl Ethyl Alcohol.

PEMEC: Phenyl Ethyl Methyl Ethyl Ketone.

PST: Pocket Smell Test.

Q-SIT: Quick Smell Identification Test.

SIT: Smell Identification Test.

SOIT: Scandinavian Odor Identification Test.

T: Threshold.

T & T: Toyota & Takagi.

TDI: Threshold Discrimination- Identification.

UPSIT: University of Pennsylvania Smell Identification Test

URI: Upper Respiratory Infection.

US: United States.

INTRODUCTION

For all species, the special sense of olfaction provides critical information about the surrounding environment. Generally known as ‘‘chemical sense’’ because of its ability to detect chemical stimuli and encode them into neural stimuli. Just as important, the chemical senses contribute significantly to quality of life, and loss of these senses can be devastating.

This chemical sense is important to humans as it determines the flavor of food and beverages and provides a sensitive and early means for detecting dangerous environmental situations. Olfaction should not be underestimated and is particularly acute for patients whose lifestyle, livelihood, or immediate safety depends on smelling and tasting (cooks, firemen, homemakers, plumbers, professional food and beverage tasters, employees of natural gas works, chemists, and numerous industrial workers).

The perception of odors adds a quality to life that is difficult to express. Odors are part of our everyday life, from the pleasures of perfume to the satisfactions of toast and coffee to the warnings of fire. As the molecules of substances are transported through the nose, the possibility of them being perceived occurs. The quality and intensity of that perception depends on the anatomic state of the nasal epithelium and the status of the peripheral and central nervous systems. ***(Donald and Holbrook, 2005)***

There are significant physiologic similarities between olfaction and taste, and one's perceptions of the two senses often overlap, but their peripheral anatomy and central neural pathways are distinct. Olfactory and taste sensory neurons possess the unique ability to replace themselves throughout the lifespan of an organism. ***(Hadley et al., 2004)***

Unfortunately, olfaction is typically ignored by otolaryngologists ***(Nakashima et al., 1984)***, even though the subject of this sense falls within the purview of their specialty; ***(Huard et al., 1998)*** even some otolaryngologic operative procedures compromise the functioning of this sense. ***(Rowley et al., 1989)***

Alterations in chemosensory function can be an early sign of a number of diseases, including Alzheimer's disease (AD) and idiopathic Parkinson's disease (PD). ***(Carr et al., 1991)***

It is estimated that olfactory dysfunction affects at least one percent of the population ***(Hadley et al., 2004)***. More recent epidemiologic data even suggests that about 5% of the population suffer from a complete loss of olfaction. ***(Donald and Holbrook, 2005)***

Basic Anatomy and Physiology of the Olfactory system

Nasal Passageways

Experiencing an odor is a result of input from the olfactory, trigeminal, glossopharyngeal, and vagus nerves. Apparently, the properties of any given odorant determine the particular "mix" of these various inputs. Olfactory nerve, cranial nerve I (CN I), stimulation, which is necessary for identification of most odorants, depends on the odorant molecules reaching the olfactory mucosa at the top of the nasal cavity. Although molecules can reach the olfactory cleft by diffusion, essentially olfaction requires some type of nasal airflow, usually as part of inhalation (orthonasal flow). While eating, there is a retronasal flow of odorant molecules that stimulate the olfactory receptors at the top of the nose and contribute greatly to the flavor of the food. ***(Chilfala and Polzella, 1995)*** This airflow can be very small, such as that generated by the mouth and pharyngeal motion. ***(Burdach and Doty, 1987)*** Measurements in nasal models have shown this flow to be laminar below the low flow rates associated with normal breathing and turbulent in most of the nasal cavity at high flow rates. ***(Girardin et al., 1983)*** Additional data from a large scale model indicate that at physiologic airflow rates, approximately 50% of the total airflow passes through the middle meatus, with approximately 35% flowing through the inferior meatus. About 15% flows through the olfactory region (Figure 1). ***(Scherer et al., 1989)***

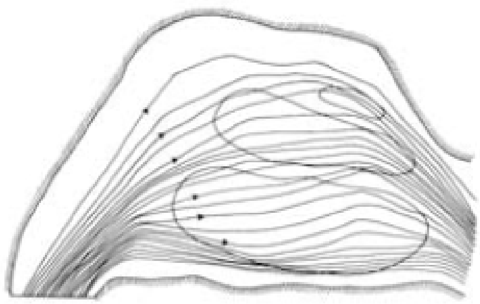

Figure 1: Streamline patterns for resting inspiratory flow through an expanded scale model of a healthy human adult male nasal cavity (sagittal view). *Lines* show the paths taken by small dust particles entering at the external nares.

With ink threads in a water flow medium through a model, it showed that even the locus of entry through the nostril can determine the path of that flow stream through the nose (Figure 2). ***(Masing, 1967)***

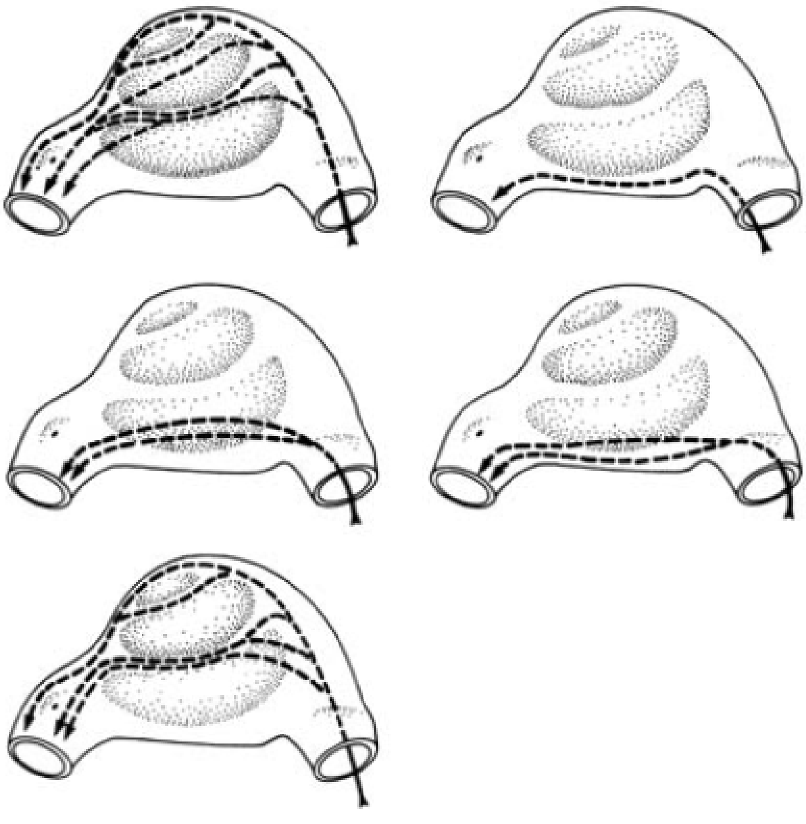

Figure 2: Masing's ink flow thread experiments using water flow through nasal model (inspiration).